Use of a forensic technique to identify blood contamination of emergency department and ambulance trauma equipment

J B Lee, M Levy, A Walker

Using a Kastle-Meyer (KM) technique, the following equipment from the emergency departments of six UK hospitals (four trusts) and three regional ambulance services was tested for blood contamination: extrication ("spinal") boards, cervical collars, straps, box splints, head blocks, and headboards. Only equipment ready for patient use was tested. Over half of trauma equipment (57%) tested positive for blood, including 15% of equipment that was visibly stained with blood. There have been no recorded cases of infection from contaminated trauma equipment but our study has identified the potential risk. Disposable covers for boards, disposable straps, and disposable radiolucent head blocks which are currently available provide a solution but have resource implications.

Forensic techniques have been used to identify blood contamination of dental, radiological, and anaesthetic equipment that appeared clean to the naked eye. The authors of these studies considered that the contaminated surfaces presented a greater risk of potential infection transmission to medical and dental staff than to patients. Equipment used to transport trauma patients may come into direct contact with open wounds. We used a forensic test to determine the extent of blood contamination of trauma equipment in a sample of ambulances and emergency departments in the UK to establish whether a potential risk of infection transmission between trauma patients exists.

METHODS

Six UK Emergency Departments (four hospital trusts) and three regional ambulance services were included in the study. Approval for testing was granted by the lead clinician of each department and the operational or medical director of the individual ambulance services with agreement that their centres would remain individually anonymous. Ethical approval was sought but not required.

Using a Kastle-Meyer (KM) technique, the following trauma equipment was tested over two weeks in 2004: extrication ("spinal") boards, cervical collars, straps, box splints, head blocks, and headboards. A validation test was first performed to exclude false negative results by confirming the ability of the reagent to identify (horse) blood. The area under investigation was then swabbed with a cotton bud, a drop of Kastle-Meyer solution added, followed by a drop of hydrogen peroxide. A colour change to pink was taken as an indication of the presence of blood. The testing kit supplied by Scenesafe (The Forensic Science Service, Chorley, UK) contained all of the above components and is identical to that used by the Metropolitan Police for identification of blood at crime scenes.

Convenience sampling of equipment in emergency departments, ambulances arriving with non-trauma patients, and ambulance stations was performed. Only equipment ready for patient use was tested. Individual emergency department staff and ambulance crews were not warned of our visits. Standardised areas, considered by the authors as those most likely to come into contact with the patient were swabbed, as shown in the following list:

- medial side of head blocks
- inner side of head straps
- patient side of head boards
- patient side of straps and buckles
- patient side of extrication boards (head, feet, and hand regions)
- patient side of box splints
- back and chin area of foam in cervical collars.

A maximum of four areas (about 3 cm square in size) were tested for each piece of equipment unless the equipment appeared visibly blood stained, in which event the stain was tested to confirm that it was blood. Testing was performed in pairs by the authors. The result was independently recorded as positive or negative by the two observers to determine interobserver agreement. In the event of disagreement, retesting of the same area was undertaken immediately.

The outcome measures of interest were: (1) equipment visibly or not visibly stained with blood and (2) positive or negative result for blood on Kastle-Meyer testing.

Equipment was considered contaminated if any area of it tested positive for blood. We decided a priori to perform a subset analysis on "hospital cleaned" versus "ambulance crew cleaned" trauma equipment with respect to blood contamination. A z-test was performed to calculate confidence intervals around the difference in proportions of contamination between the two groups.

RESULTS

Fifteen per cent of equipment was visibly contaminated with blood. A further 42% of equipment, not visibly contaminated, tested positive for blood with the Kastle-Meyer test. Observers agreed on colour change on all samples tested. See tables 1 and 2 for comparative results.

DISCUSSION

The Kastle-Meyer test is a presumptive test for haemoglobin which relies on the peroxidase-like activity of the haem molecule and uses phenolphthalein as a colour indicator (see fig 1). It is very specific for blood and although not as sensitive as other reagents can still identify blood at 1 part per

Abbreviation: DoH, Department of Health
Table 1 Overall blood contamination on Kastle-Meyer testing by equipment type

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Proportion testing +ve for blood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extrication boards</td>
<td>26/36 (72%)</td>
</tr>
<tr>
<td>Boxsplints</td>
<td>36/52 (69%)</td>
</tr>
<tr>
<td>Head blocks</td>
<td>50/76 (66%)</td>
</tr>
<tr>
<td>Head guards</td>
<td>21/34 (62%)</td>
</tr>
<tr>
<td>Head straps</td>
<td>36/66 (55%)</td>
</tr>
<tr>
<td>Straps</td>
<td>83/170 (49%)</td>
</tr>
<tr>
<td>Cervical collars</td>
<td>27/57 (47%)</td>
</tr>
<tr>
<td>Total</td>
<td>279/491 (57%)</td>
</tr>
</tbody>
</table>

Table 2 Ambulance trauma equipment contamination on Kastle-Meyer testing (hospital staff cleaned versus ambulance crew cleaned)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Proportion +ve for blood (%)</th>
<th>Hospital staff cleaned</th>
<th>Ambulance crew cleaned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extrication boards</td>
<td>11/16 (69%)</td>
<td>4/8 (50%)</td>
<td></td>
</tr>
<tr>
<td>Boxsplints</td>
<td>21/28 (75%)</td>
<td>4/11 (36%)</td>
<td></td>
</tr>
<tr>
<td>Head blocks</td>
<td>23/32 (72%)</td>
<td>6/16 (37%)</td>
<td></td>
</tr>
<tr>
<td>Head straps</td>
<td>11/16 (69%)</td>
<td>5/8 (62%)</td>
<td></td>
</tr>
<tr>
<td>Head straps</td>
<td>20/32 (62%)</td>
<td>7/16 (44%)</td>
<td></td>
</tr>
<tr>
<td>Straps</td>
<td>41/90 (46%)</td>
<td>21/48 (44%)</td>
<td></td>
</tr>
<tr>
<td>Cervical collars</td>
<td>13/27 (48%)</td>
<td>5/16 (31%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>140/241 (58%)</td>
<td>52/123 (42%)</td>
<td></td>
</tr>
</tbody>
</table>

Difference in contamination (95% CI) 15.8% (5.0 to 26.6%)

ACKNOWLEDGEMENTS

The authors would like to thank the clinical directors of the emergency departments and the directors of the ambulance services for their permission to test equipment, and the individual ambulance crews for their cooperation. We would also like to thank the members of the Mid-Yorkshire Research Group and Dr J Brenchley for their helpful comments on the structuring of the paper.

Authors’ affiliations
J B Lee, A Walker, Pinderfields General Hospital
M Levy, The General Infirmary at Leeds, Leeds, UK

Funding: Funding for the study was provided by the Faculty of Emergency Medicine Research Committee. Results presented at the Faculty of Accident and Emergency Medicine Conference (November 2004). The researchers were independent from the funders.

Competing interests: none.

Ethics: ethical approval was not required.

Correspondence to: Mr J B Lee, Pinderfields General Hospital;
docjasonlee@hotmail.com

Accepted for publication 21 May 2005
REFERENCES

3 Perry SM, Managhan WP. The prevalence of visible and/or occult blood on anaesthesia and monitoring equipment. AANA J 2001;69:44–8.
11 Medical Advisory Committee (MAC). Sterilization, cleaning and disinfection of medical equipment guidance on decontamination to the Department of Health, MAC manual 2004 CD-ROM.
CORRECTIONS

doi: 10.1136/emi.2005.25346corr1

The author affiliations and correspondence details are incorrect for the paper titled, Use of a forensic technique to identify blood contamination of emergency department and ambulance trauma equipment (Emerg Med J 2005;22:617-20). The correct author affiliations are:

JB Lee, M Levy, Yorkshire Deanery UK
A Walker, Mid-Yorkshire Hospital Trust, UK

Correspondence should be sent to: Miss A Walker, Mid-Yorkshire Hospitals Trust, UK; alison.walker1@midyorks.nhs.uk.

doi: 10.1136/emi.2003.13987corr2